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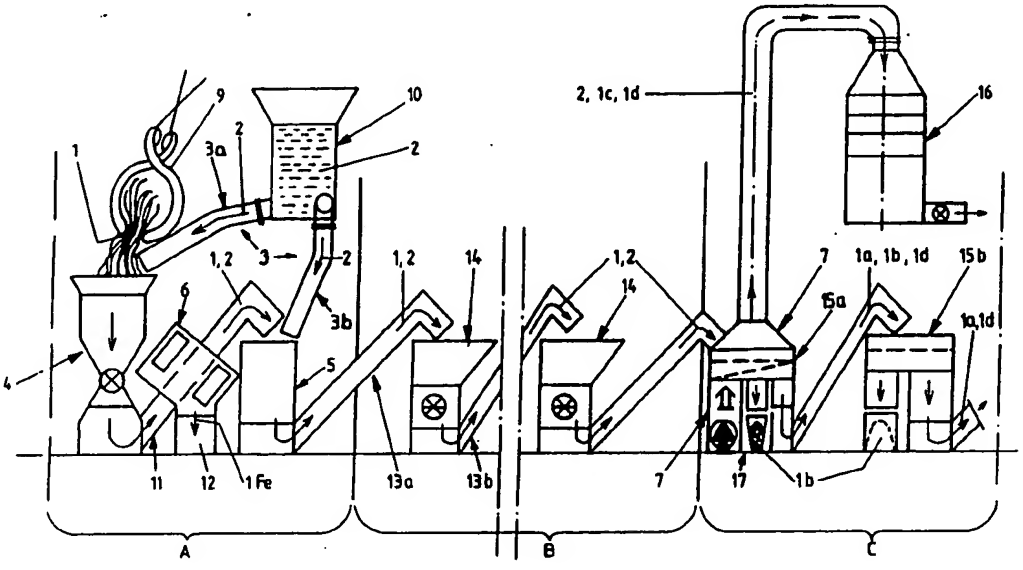

(57) Abstract

The method according to the invention is applied for the treatment of a cable material (1) or the like, wherein the cable material (1) or the like is crushed (A), granulated (B) and sieved (C). The processing results in the separation of at least part of the submaterials of the cable material (1) or the like, such as the casing material (1a) based on plastics, rubber, wood or the like, and the metal-based core material (1b). According to the invention, for the treatment of a so-called jelly-filled cable or the like, the viscous filling material (1c) in a fluid or solid state being a submaterial thereof, the said filling material (1c) is absorbed during the processing to a medium (2), whereby the processing results in the separation of the filling material (1c) of the cable material (1) or the like absorbed in the said medium (2).

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Method for the treatment of cable material or the like

The invention relates to a method for the treatment of cable material or the like, wherein the cable material or the like is crushed, granulated and sieved, resulting in the separation of at least part of the submaterials of the cable material or the like, such as the plastic-, rubber-, wood-based or corresponding casing material and metal-based core material. The method according to the invention is intended particularly for the treatment of cable material, such as telecommunications cables, power cables or the like, for their at least partial recycling.

Conventionally, two different methods have been used for the treatment of cable material, depending on the cable material.

For the treatment of so-called dry cables, a method has been successfully used, in which the cable material is crushed, granulated and sieved, whereby the mechanical treatment results in separation of the metal and non-metal materials of the cable material from each other. These dry cables, such as electric cables or the like, comprise an electroconductive core material which is covered by a dry, insulating casing material. In the casing material, a rubber or plastic casing or the like can be used as the insulating material; the cable can thus also comprise a powderized or solid mass, such as textile fibres or the like.

Previously, a method based on melting or combusting has been primarily used for the treatment of so-called jelly-filled cables. Thus, the cable material is e.g. first preheated in a heating apparatus, such as an oven, whereby the casing, insulating and filling materials covering the metal core material of the cable melt or burn, and the core material remaining

solid can be removed from the heating apparatus. After this, an afterburning apparatus with a very high temperature is generally used for securing the burn-out of non-metal materials, such as plastics, rubbers or the like. In this connection, the term jelly-filled cables is used to denote to cables in which a viscous, fat-, oil-, wax-based or the like filling material in a fluid or solid state, such as an insulator, impregnant or lubricant, is used as part of the material.

An advantage of the first method is its environmental safety, whereby the method as such causes no direct environmental risks. However, the method is not applicable for the treatment of so-called jelly-filled cables, because the apparatus does not function in connection with these cables due to their viscous filling materials, such as vaselin, bitumen or paraffin. The filling material induces thus arching of both granulating and sieving apparatuses, in which case the conveyor apparatuses will be clogged or there will be an overflow in the process. These test runs have also not even in the early stages given a sufficiently pure sieving result, due to the contaminating effect of the filling material.

The second method presented comprises both direct and indirect environmental risks due to the combustion of cables. Depending on the plastic materials used in the cables, the method may also cause actual damage to the environment in the form of smoke and smell. In addition, there are special regulations for certain plastics, whereby their combustion is possible at appropriate refuse incineration plants only. One such particularly harmful substance is PVC. Therefore, using a method based on combustion, the cable material to be burnt must be sorted out according to burnability, whereby problem wastes, such as cables containing

PVC, must be delivered to the appropriate plants. In practice, however, this sorting is not possible without a chemical analysis of the cable material to be treated. Thus in practice, when a method based on combustion is used, the quality of all burnable material is never fully checked out, whereby the risk of the development of so-called super-poisons is always present in connection with the combustion. For minimizing the security risks, the application of the method requires continuous control of such processes as well as assay of discharges at certain intervals.

Consequently, the methods currently in use do not make it possible to apply the treatment of cable materials or the like in a manner that is both technically and economically advantageous and gives good results by environmentally safe means.

It is an aim of the method according to the present invention to attain a decisive improvement to the drawbacks presented above and thus to raise substantially the level of prior art in the field. For achieving this aim, the method according to the invention is primarily characterized in that particularly for the treatment of a cable material or the like, in which a viscous, fat-, oil-, wax-based or the like filling material in a fluid or solid state, such as an insulator, impregnant, lubricant and/or the like is used as part of the material, the said filling material is absorbed during the treatment into a medium, whereby the treatment results in separation of the filling material of the cable material or the like absorbed into the medium.

The most important advantages of the method according to the invention are the simplicity and reliability of the principle and of the apparatus and process applying the method. Further, the method and the

apparatus according to the invention are also advantageous in comparison with the methods currently in use from the environmental aspect and the aspect of occupational safety. The apparatus for applying the method according to the invention or the process in the same do not induce any risks to the environment nor to occupational safety which would be directly or indirectly caused e.g. by the combustion process in methods based on combustion. Particularly compared with combustion units, the apparatus applied in the method according to the invention is also substantially less expensive with respect to total costs, thanks to the lesser internal power consumption required in the process.

Advantageous embodiments of the method according to the invention are presented in other dependent claims.

In the following description, the invention is illustrated in detail with reference to the appended drawings, in which

Fig. 1a shows a cross-sectional view of a so-called dry cable,

Fig. 1b shows a cross-sectional view of a so-called jelly-filled cable, and

Fig. 2 shows a schematic view of the process in the apparatus for applying the method according to the principle.

The method according to the invention is applied for the treatment of a cable material 1 or the like, whereby the cable material 1 or the like is crushed A, granulated B and sieved C. The treatment results in the separation of at least part of the submaterials contained in the cable material 1 or the like, such

as the casing material 1a based on plastics, rubber, wood or the like, and the core material 1b based on metal. For treatment of a so-called jelly-filled cable or the like according to the invention, part of the material containing a viscous filling material 1c in a fluid or solid state, the said filling material 1c is absorbed during the processing into a medium 2, whereby the treatment results in the separation of the filling material 1c of the cable material 1 or the like absorbed into the said medium 2.

Figure 1a shows a cross-sectional view of a so-called dry cable as an example. The cable is thus formed of metal conduits 1b (e.g. copper, aluminum, brass), plastic casings 1a covering them, and of mass 1d placed between the plastic casings 1a of the conduits 1b and the outer casing of the cable, such as textile fibres or the like.

Figure 1b shows a so-called jelly-filled cable, in which conduits 1b are covered e.g. by an impregnated paper layer 1p covered by a plastic casing 1a. Mass 1d is placed between the outer casing of the cable and the plastic casings 1a of the conduits 1b. As an insulator and impregnants in the paper layers 1p covering the conduits 1b, filling material 1c based on fat, oil, wax or the like is used, such as bitumen, vaselin or paraffin. Also the mass 1d is usually impregnated with a corresponding substance.

According to the process shown in Fig. 2, the filling material 1c is absorbed into the medium 2 by bringing the medium 2 and the cable material 1 into contact with each other at the crushing stage A, whereby the absorption of the filling material 1c into the medium 2 takes place during the treatment as the cable material 1 and the medium 2 are mixed with each other.

At the crushing stage A, the medium 2 is supplied by the supply equipment 3, such as a pneumatic, mechanic or corresponding conveyor, to the crushing equipment 4, formed in the presented embodiment by one crusher, and to the intermediate depot 5 placed after the crushing equipment 4. The intermediate depot 5 is intended for balancing the mass flow of the crushed cable material 1 passing from the crushing stage A to the granulation stage B. In connection with the crushing stage A, ferrous substances 1Fe are removed from the cable material 1 by means of a metal eliminating means 6, such as an electromagnetic actuator or the like, placed between the crushing equipment 4 and the intermediate depot 5. The filling material 1c absorbed into the medium 2 is removed at the sieving stage C by separating equipment 7 which in the present embodiment is a wind sieve based on the differences in the specific weights of the partial materials of the cable material 1 to be treated.

In the test runs of the process according to the method, the medium 2 was primarily horticultural peat, which has a specific weight of ca. 100 kg/m^3, humidity of ca. 20%, a mineral soil content in dry substance of ca. 3%, and a particle size (dimension in one direction) of ca. 8 mm, with a ca. 50% content of particles with a size smaller than 1 mm.

It is naturally possible to use a variety of substances as the vegetable medium; results from continuous development indicate that husk from barley can be used as such or in a suitable mixture. Thus the specific weight of the medium is 50-200 kg/m^3, the humidity is lower than 30%, and the particle size (dimension in one direction) is 0.1 to 20 mm, and the content of particles smaller than 5 mm in size is 30 to 70%.

In the process shown in Fig. 2, the cable material 1 is transferred at the crushing stage A by a lifting apparatus 9 to the crusher 4. The crusher 4 is supplied with medium 2 from the medium depot 10 by the first supply means 3a. The cable material 1 crushed in the crusher 4 as well as the medium 2 supplied to the crusher to mix with it are transferred by the first conveyor 11 to the intermediate depot 5. The electromagnetic actuator 6 arranged in connection with the first conveyor 11 removes ferrous particles 1Fe from the crushed material flow 1, 2 carried on the conveyor 11 to a container 12. Medium 2 is supplied by a second supply means 3b to the intermediate depot 5. Good mixing is achieved at the intermediate depot 5; also the volume of the crushed material flow 1, 2 passing to the granulation stage B is balanced at the intermediate depot 5.

At the granulation stage B, the crushed material flow 1, 2 carried from the intermediate depot 5 by a second conveyor 13a is supplied to successive granulators 14. The number of granulators 14 used in the process can be varied according to the quality of the cable material 1 to be treated.

At the sieving stage C, the granulated material flow 1, 2 is supplied to a first separator 15a functioning on the principle of a shaking sieve, a wind sieve 7 being arranged to function in connection with the same. Upon passing through the sieve surface, the air flow carries away the part of the granulated material 1, 2 with the lowest specific weight, i.e. the medium, such as the horticultural peat 2 and the viscous filling material absorbed in it, such as fat 1c and part of the mass 1d, which is conveyed to a cyclon 16. The first separator 15a is used for separating the core material with the highest specific weight, such as copper 1b, to a container 17, and the casing material

with a lower specific weight, such as plastic 1a and part of the mass 1d, to further processing. The material flow carried to further processing may also contain particles of the core material 1b, which in the presented embodiment are separated in a second separator 15b. The fine screening in the second separator 15b is used for final separation of the casing material 1a and part of the mass 1d from the core material 1b. The casing material 1a can be carried e.g. by a conveyor to suitable further processing. Consequently, pure copper 1b, fatty horticultural peat 2, 1c, 1d and casing material 1a and mass 1d with specific weights between those of the above-mentioned are given as a result of the process applying the method.

The method according to the invention can thus be used for separation of the core material 1b from the cable material 1 for environmentally fully safe recycling. The fatty horticultural peat removed from the cyclon 16 is also e.g. decomposable as such, and the casing material 1a from the second separator 15b can be reutilized in one form or another.

It is clear that the invention is not restricted to the embodiment presented above but it can be modified within the basic idea even to a great extent because of the wide total range of the process for applying the method. The apparatus for applying the method according to the invention can comprise devices which vary from those presented in number and principles of function. Consequently, constructions related to the supply and discharge of the medium can be made in a number of different ways, whereby the medium can be mixed e.g. with a fluid before or in connection with mixing with the cable material.

Claims:

1. Method for the treatment of cable material or the like, whereby the cable material (1) or the like is crushed (A), granulated (B) and sieved (C), the treatment resulting in the separation of at least part of the submaterials of the cable material (1) or the like, such as a casing material (1a) based on plastics, rubber, wood or the like, and a metal-based core material (1b) from each other, **characterized** in that particularly for the treatment of a cable material or the like in which a viscous, fat-, oil-, wax-based or the like filling material (1c) in a fluid or solid state, such as an insulator, impregnant, lubricant and/or the like, the said filling material (1c) is absorbed during the treatment into a medium (2), whereby the treatment results in the separation of the filling material (1c) of the cable material (1) or the like absorbed into the said medium (2).

2. Method according to claim 1, **characterized** in that the absorption of the filling material (1c) in the medium (2) is achieved by bringing the medium (2) into a contact with the cable material (1) or the like at the crushing stage (A) and/or the granulating stage (B), whereby the absorption of the filling material (1c) takes place during the treatment upon the mixing of the cable material (1) or the like and the medium (2) with each other.

3. Method according to claim 1 or 2, **characterized** in that the medium (2) is supplied at the crushing stage (A) by supply equipment (3), such as one or more pneumatic, mechanic or corresponding conveyor, to crushing equipment (4) formed by one or several crushers and/or to balancing equipment (5) arranged in connection with the crushing equipment (4), such as

an intermediate depot, conveyor arrangement or the like, for controlling the mass flow of the crushed cable material (1) or the like passing from the crushing stage (A) to the granulating stage (B).

4. Method according to claim 3, **characterized** in that at the crushing stage (A), at least the ferrous substances (1Fe) are removed from the cable material (1) or the like, preferably by metal eliminating means (6) arranged between the crushing equipment (4) and the balancing equipment (5), such as one or more magnets, electromagnetic actuators or the like.

5. Method according to one of the claims 1 to 4 above, **characterized** in that the filling material (1c) absorbed in the medium (2) is removed at the granulation stage (B) and/or the sieving stage (C) by separating equipment (7) based on the differences in the specific weights of the submaterials of the cable material (1) or the like to be treated.

6. Method according to claim 5, **characterized** in that the filling material (1c) absorbed in the medium (2) is removed at the sieving stage (C) by a flow arrangement (7), such as a wind sieve or the like, arranged in connection with the sieving equipment (15a), such as preferably a separator or the like functioning on the principle of a shaking sieve.

7. Method according to one of the claims 1 to 6 above, **characterized** in that the medium (2) used is a vegetable substance, such as one based on peat, wood or the like, with a specific weight of 50 to 150 kg/m^3.

8. Method according to claim 7, **characterized** in that the medium (2) used is a peat-based substance,

such as horticultural peat or the like, with a humidity lower than 30%.

9. Method according to claim 7 or 8, **characterized** in that the medium (2) used is a peat-based substance, such as horticultural peat or the like, with a mineral soil content lower than 5% of the dry substance.

10. Method according to claim 7, 8 or 9, **characterized** in that the medium used is a peat-based substance, such as horticultural peat or the like, in which the particle size (dimension in one direction) is 0.1 to 10 mm and the content of particles smaller than 1 mm in size is 30 to 70%.

11. Method according to one of the claims 1 to 6, **characterized** in that the medium (2) used is a vegetable substance, such as grain-based waste from the husking of barley, with a specific weight of 50 to 200 kg/m^3, humidify lower than 30%, and in which the particle size (dimension in one direction) is 0.1 to 20 mm and the content of particles smaller than 5 mm in size is 30 to 70%.

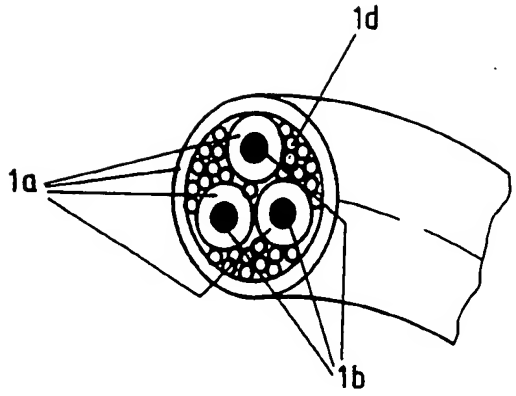

Fig 1a

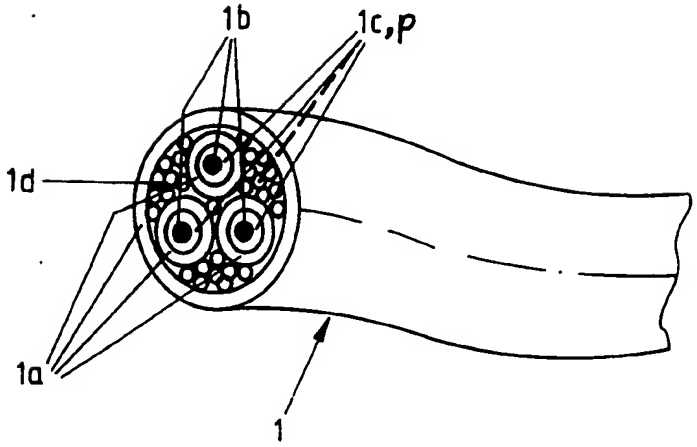

Fig 1b

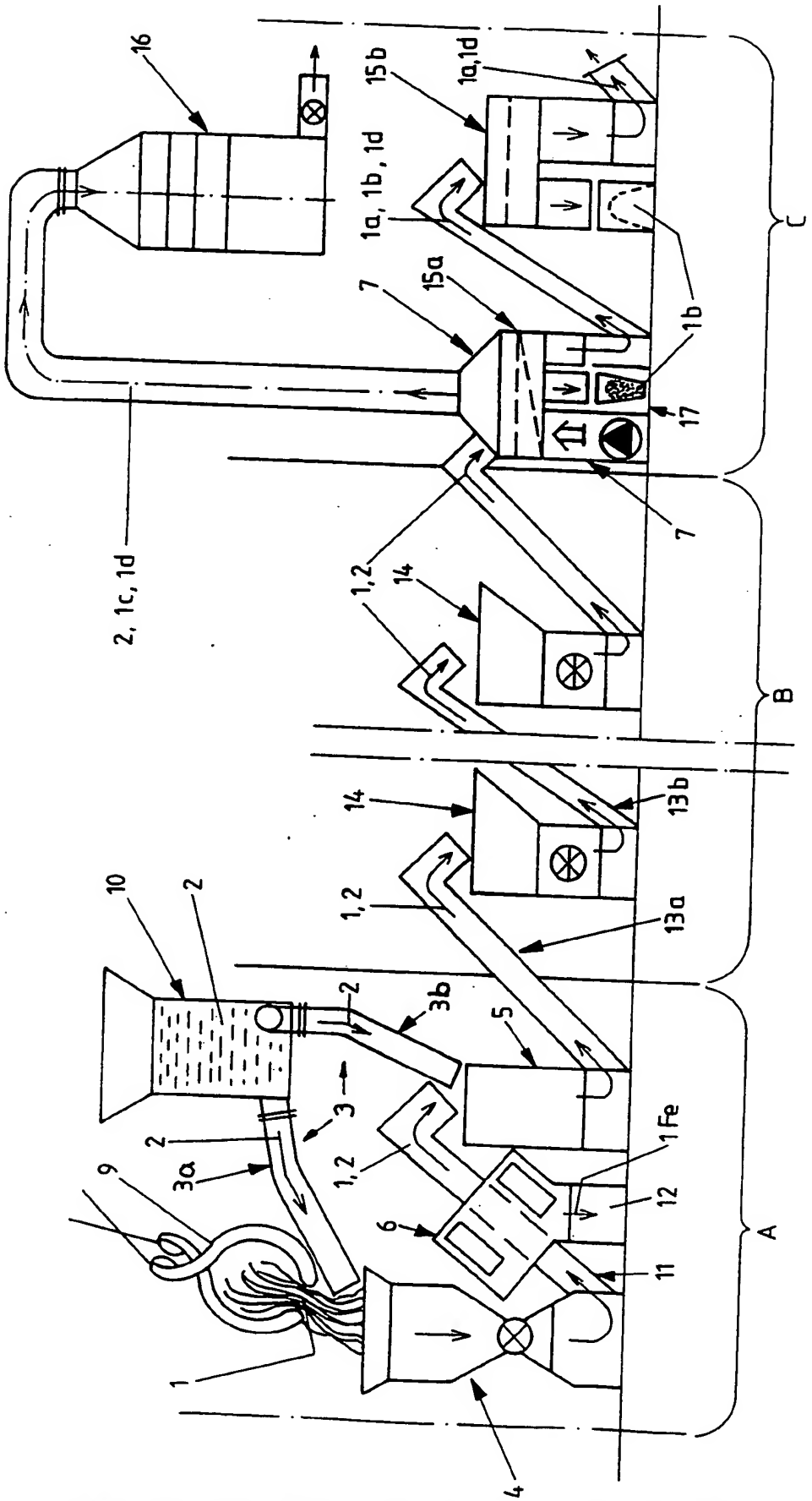
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Fig 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 92/00108

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[5]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: H 01 B 15/00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	H 01 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	BE, A7, 1001789 (CARNEY) 6 March 1990, see claim 1	1-6
A	--	7-11
P,X	GB, A, 2241181 (CARNEY) 28 August 1991, see abstract	1-6
	--	
X	WO, A1, 8202348 (WESTERN ELECTRIC) 22 July 1982, see the whole document	1-6
A	--	7-11
X	US, A, 4332677 (BUDZICH) 1 June 1982, see column 1, line 11 - line 44	1-6
A	--	7-11

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
25th July 1992	1992 -07- 29
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Anders Axberger

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 4022638 (WEET) 10 May 1977, see abstract --	1-11
A	DE, B, 2608739 (WESTERN ELECTRIC) 20 July 1978, see claims 1-8 --	1-11

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 92/00108

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 29/05/92
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
BE-A7- 1001789	90-03-06	NONE		
GB-A- 2241181	91-08-28	NONE		
WO-A1- 8202348	82-07-22	GB-A-B-	2104802	83-03-16
		US-A-	4363449	82-12-14
US-A- 4332677	82-06-01	NONE		
US-A- 4022638	77-05-10	CA-A-	1086506	80-09-30
		DE-A-B-C	2635201	77-02-10
		FR-A-	2320620	77-03-04
		GB-A-	1531060	78-11-01
		JP-A-	52020304	77-02-16
DE-B- 2608739	78-07-20	CA-A-	1057449	79-06-26
		FR-A-B-	2302834	76-10-01
		GB-A-	1533275	78-11-22
		JP-C-	1063538	81-09-22
		JP-A-	51113176	76-10-06
		JP-B-	56004175	81-01-29
		NL-A-	7602338	76-09-09
		US-A-	3976563	76-08-24